AD-A144 590 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS MANITOOK LAKE DAM (CT.. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV NOV 79 1/1

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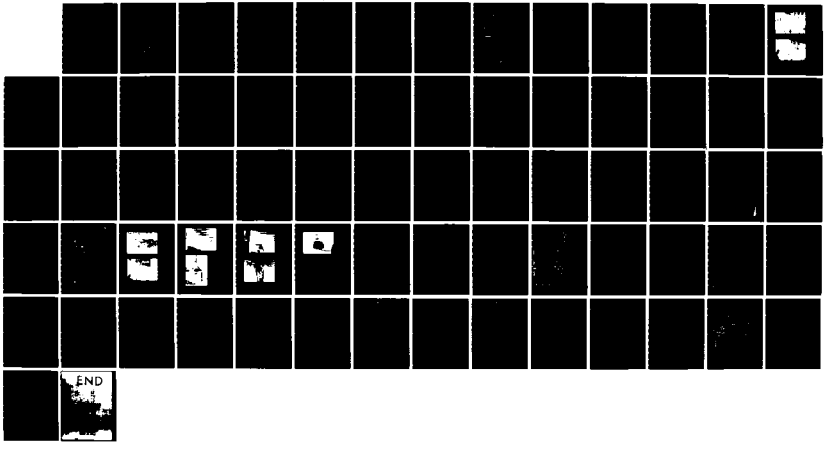

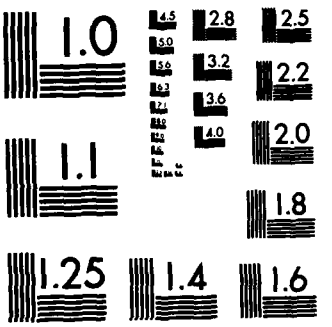

CONNECTICUT RIVER BASIN
GRANBY, CONNECTICUT

MANITOOK LAKE DAM

CT. 00672

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

NOVEMBER 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Connecticut River Basin
Granby, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Manitook Lake Dam is a composite masonry and earth dam consisting of two masonry building foundations, separated by an 18 ft. long masonry wall. The entire length of the dam is about 108 ft. long. The dam is judged to be in fair condition. The height of the dam is about 13.5 ft.; the size classification is thus small. Based on small size and significant hazard, the range for the test flood is 100 year to ½ PMF.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

FEB 4 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Manitook Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Mr. Joseph Radwillowicz, Granby, Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

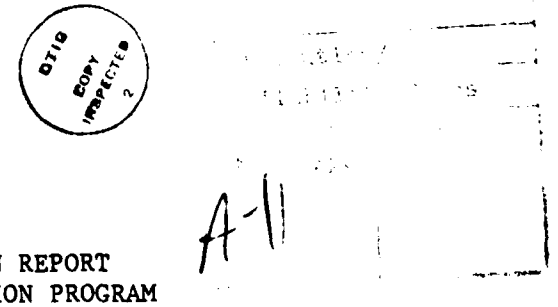
MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

MANITOOK LAKE DAM

CT 00672

CONNECTICUT RIVER BASIN
GRANBY, CONNECTICUT



A-11

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	CT 00672
Name of Dam:	Manitook Lake Dam
Town:	Granby
County and State:	Hartford County, Connecticut
Stream:	Unnamed
Date of Inspection:	9 and 24 October 1979

BRIEF ASSESSMENT

Manitook Lake Dam is a composite masonry and earth dam consisting of two masonry building foundations, separated by an 18 ft. long masonry wall and an upstream earth embankment. The entire length of the dam is about 108 ft. long. The building foundations support buildings which are used for storage and to accommodate the Old Mill Pond Village Store which occupies the premises of the dam. The dam once furnished the water needs of a mill located at the damsite but no longer serves that purpose. The impounded waters are now used for recreational purposes and several houses are located on the western shores of the lake.

The lake behind the dam is about 6,500 ft. long and has a surface area at spillway crest level of about 92 acres. The drainage area above the dam is 1.53 sq. mi. and the maximum storage to top of dam is estimated at about 667 acre-ft. The height of the dam is about 13.5 ft.; the size classification is thus small. A breach of the dam would affect the two commercial buildings located at the dam site, a house downstream and two other structures. The dam has been classified as having a significant hazard potential. Based on small size and significant hazard, the range for the test flood is 100 year to ½ PMF. The selected test flood for the project is ½ PMF.

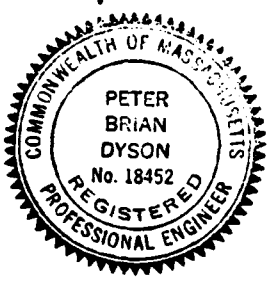
The dam is judged to be in fair condition at the present time owing to the absence of an operative dewatering facility and lack of recent maintenance. Seepage, estimated at 20 gpm, was noted at the downstream toe of the 18 ft. long wall which connects the two building foundations.

The test flood inflow for the facility equals 2,250 cfs. The routed test flood outflow of 1,580 cfs overtops the dam by 1.77 ft. The spillway can pass 97 cfs or about 6 percent of the routed test flood outflow without overtopping the dam.

Within one year after receipt of this Phase I Inspection Report, the owner, Mr. Joseph Radwillowicz, should retain the services of a registered professional engineer and implement the results of his evaluation of the following: (1) assess further the potential for overtopping and the adequacy of the spillway; (2) study the feasibility of putting the turbine gate back into operating condition and using the facility as a means for safely draining the ponded water above the dam; (3) study the cause of seepage at the toe of the 18 ft. long masonry wall which connects the building foundations; and (4) review possible elimination of the use of spillway stoplogs, or modifications to facilitate their quick removal.

The owner should also implement the following operating and maintenance measures: (1) remove trees at the base of the dam just below the spillway and one tree on the upstream face of the dam; (2) repoint missing mortar in joints of the masonry wall and building foundations adjacent to the spillway discharge channel; (3) develop a formal surveillance and flood warning plan; and (4) institute procedures for an annual periodic technical inspection of the dam.

Peter B. Dyson
Project Manager



This Phase I Inspection Report on Manitook Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Foundation & Materials Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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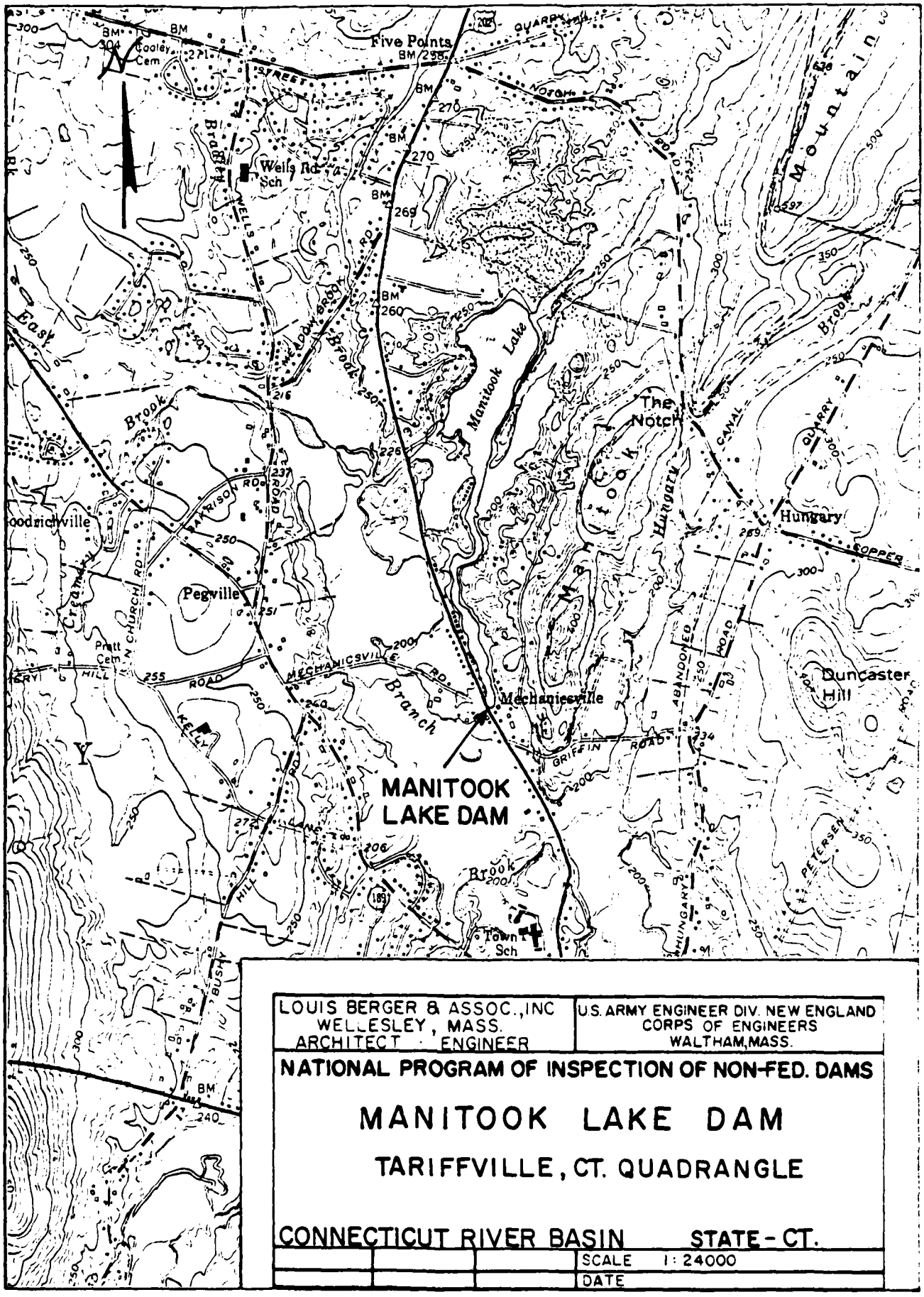
Overview of Dam from Right Abutment

Overview of Upstream Face of Dam



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MANITOOK LAKE DAM

TARIFFVILLE, CT. QUADRANGLE

CONNECTICUT RIVER BASIN STATE - CT.

			SCALE 1:24000
			DATE

PHASE I INSPECTION REPORT

MANITOOK LAKE DAM CT 00672

SECTION I - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 28 September 1979 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-79-C-0051, Job Change No. 2 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Manitook Lake and Dam are located on an unnamed tributary of the East Branch of Salmon Brook near the community of Mechanicsville in the town of Granby, Hartford County, Connecticut. The dam is located 2.65 miles upstream from the East Branch's confluence with the West Branch of Salmon Brook where the two brooks join together to form Salmon Brook. About 4.35 miles below the dam, Salmon Brook joins the Farmington River near the community of Tariffville. The dam site is shown on U.S.G.S. Quadrangle, Tariffville, Conn. - Mass., with coordinates approximately at N 41° 58' 06", W 72° 47' 44".

b. Description of Dam and Appurtenances. Manitook Lake Dam is a storage facility constructed around 1900 as part of a small mill complex. Sometime in the past the mill was abandoned and the dam no longer serves its original intent.

Manitook Lake Dam is a 13.5 ft. high and 108 ft. long composite earth and masonry dam constructed across a small swale on an unnamed brook. Essentially the dam consists of two masonry building foundations and an 18 ft. long masonry wall constructed between the two building foundations, with an earth embankment

constructed on the upstream side of the wall and foundations. The building and foundation on the left side of the center wall is about 40.5 ft. long and the building and foundation on the right side is about 50 ft. long. The two buildings which were once part of the mill complex are now used for storage and the sale of gifts and furniture.

The two buildings are connected by an enclosed wooden catwalk which passes over the masonry wall and spillway located between them. An asphalt paved road crosses the earth embankment part of the dam, serving as a driveway for the commercial establishment which is located in the two buildings on the dam. A wooden planked bridge allows traffic to cross over the approach channel to the spillway. The crest of the dam varies in width, with a minimum of about 25 ft. in the vicinity of the spillway and connecting masonry wall. The upstream face of the dam varies in slope. Part of the upstream face in the area of the spillway is retained by a vertical concrete wall.

The inlet and gate structure for an old turbine which is housed in the basement of the building to the right of the spillway are located about 25 ft. to the right of the spillway approach channel.

The spillway for the facility is constructed of concrete and is 4 ft. wide at its narrowest point and bottom crest. The spillway widens out to a width of 6 ft. at a point 2.5 ft. above the bottom crest and retains this width to the top of dam. The spillway has been constructed to accommodate 4 ft. long by 1.6 ft. high stop logs. The approach channel to the spillway is about 24 ft. long and has concrete walls, which also serve as the bridge seats for the wooden planked bridge passing over the channel.

Below the spillway there is an old submerged timber crib which extends about 25 ft. downstream in the outlet channel. Just below this timber crib the discharge channel from the turbine facility joins the main outlet channel.

c. Size Classification. Manitook Lake Dam has a hydraulic height of about 13.5 ft., and impounds a normal storage of about 304 acre-ft. to spillway crest level and a maximum of about 667 acre-ft. to the top of dam. In accordance with the size and capacity criteria given in Recommended Guidelines for Safety Inspection of Dams, the project falls into the small category and therefore is classified accordingly.

d. Hazard Classification. About 300 ft. downstream of the dam the discharges from Manitook Lake join the East Branch of Salmon Brook. The East Branch of Salmon Brook in this vicinity has a relatively wide and flat flood plain. The valley width extends to a maximum of about 1,500 ft. at a point 600 ft. downstream of the dam. The valley is relatively wide for its entire length as it joins up with the West Branch of Salmon Brook at a point 2.65 mi. below the dam and then continues on for another 1.7 miles, where Salmon Brook joins the Farmington River. The only exceptions to the above are at four roadway crossings and a railway crossing. The wide valley would dampen a sudden surge from a breach of the dam. It is estimated that a breach would cause

about a 5 ft. rise in water surface elevation at a point 3,000 ft. downstream of the dam, and a rise of 2 ft. at a point 8,000 ft. downstream of the dam. At U.S.G.S. Gaging Station 01189390 located just downstream of the highway bridge on State Route 20 it is estimated that the flood stage would be about 8.6 ft. or elevation 169.3, somewhat higher than bank full, and that no significant damages would occur below this point.

A sudden failure of the dam would result in the loss of the two commercial buildings located adjacent to and on the dam, and would probably cause damage to one house and two other structures located just upstream from State Route 20. Consequently, Manitook Lake Dam has been classified as having a significant hazard potential, in accordance with the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership. Manitook Lake Dam is owned by Joseph Radwillowicz, Old Mill Pond Village Store, Routes 10 and 202, Granby, Connecticut.

f. Operator. Mr. Joseph Radwillowicz, Old Mill Village Store, Routes 10 and 202, Granby, Connecticut. Telephone: (203) 653-3433.

g. Purpose of Dam. The dam was originally constructed to create industrial water storage for milling operations. The dam no longer serves its original purpose. However, the impounded waters are now used for recreational purposes. Numerous houses are located along the western shores of the lake.

h. Design and Construction History. It is not known by whom the dam was designed or constructed. A State of Connecticut Dam Inventory Sheet dated 1967 indicates that the dam may have been constructed around the year 1900.

i. Normal Operating Procedure. Operating procedures consist of installing and removing the spillway stop logs. The stop logs are removed in the springtime of the year to accommodate spring runoff and installed for the rest of the year to keep the lake at a higher level for the pleasure of landowners abutting the lake. The turbine gate is inoperative as the stem is broken.

1.3 Pertinent Data

a. Drainage Area. The drainage area contributing to Manitook Lake is situated at the headwaters of an unnamed brook which enters the East Branch of Salmon Brook. The drainage area encompasses a total of about 1.53 sq. mi. (979 acres), of which 92 acres are occupied by the lake. The longest circuitous stream course contributing to the lake is about 6,300 ft. long with an elevation difference of about 444 ft., or a slope of about 373 ft. per mile. The drainage area has a length of about 2.1 miles and a maximum width of about 1.2 miles. The basin consists of both open fields and forested areas and medium density housing development.

b. Discharge at Damsite

(1) Outlet Works Conduit. Low level discharges from Manitook Lake are provided for by a turbine conduit of undetermined size. The inlet invert of

the conduit could not be determined and the control gate for the conduit is inoperative due to a broken stem.

(2) Maximum Known Flood at Damsite. No records are available of flood inflows into Manitook Lake, nor of spillway releases and surcharge heads during such flows.

(3) Ungated Spillway Capacity at Top of Dam. The total spillway capacity at top of dam, elevation 197.6, is 97 cfs.

(4) Ungated Spillway Capacity at Test Flood Elevation. The ungated spillway capacity is about 180 cfs at test flood elevation 199.37 NGVD.

(5) Gated Spillway Capacity at Normal Pool Elevation. Not applicable

(6) Gated Spillway Capacity at Test Flood Elevation. Not applicable.

(7) Total Spillway Capacity at Test Flood Elevation. The total spillway capacity at the test flood elevation is the same as (4) above, 180 cfs at elevation 199.37 NGVD.

(8) Total Project Discharge at Test Flood Elevation. The total project discharge at test flood is 1,580 cfs at elevation 199.37 NGVD.

c. Elevations (Ft. above NGVD)

(1) Streambed at centerline of dam - 184.1

(2) Maximum tailwater - Not available

(3) Upstream portal invert diversion tunnel - Not applicable

(4) Recreation pool - Not applicable

(5) Full flood control pool - Not applicable

(6) Ungated spillway crest - 194.0 (195.6 with stoplogs)

(7) Design surcharge (original design) - Unknown

(8) Top of dam - 197.6

(9) Test flood design surcharge - 199.37

d. Reservoir

(1) Length of maximum pool - 6,500 ft.

(2) Length of recreation pool - Not applicable

(3) Length of flood control pool - Not applicable

e. Storage (acre-ft.)

(1) Recreation pool - Not applicable

(2) Flood control pool - Not applicable

(3) Spillway crest pool El. 194.0 - 304

(4) Top of dam El. 197.6 - 667

(5) Test flood pool El. 199.37 - 865

f. Reservoir Surface (acres)

(1) Recreation pool - Not applicable

(2) Flood control pool - Not applicable

(3) Spillway crest El. 194.0 - 92

(4) Top of dam El. 197.6 - 109

(5) Test flood pool El. 199.37 - 118

g. Dam

(1) Type - Gravity overflow with downstream masonry section and upstream earth fill

(2) Length - 108 ft.

(3) Height - 13.5 ft.±

(4) Top width - Varies, 25 ft. at narrowest point

(5) Side slopes - Downstream - vertical masonry walls. Upstream varies

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - Unknown

(9) Grout curtain - Unknown

h. Diversion and Regulating Tunnel - Not applicable

i. Spillway

(1) Type - Ungated broadcrested weir (with provision for stoplogs)

(2) Length of weir - 4 ft. at El. 194, 6 ft. at El. 196.5

(3) Crest Elevation - 194 MSL

(4) Gates - None

(5) Upstream channel - Concrete channel

(6) Downstream channel - Natural stream channel

j. Regulating Outlets

(1) Invert - 184 NGVD (approximately)

(2) Size - Unknown

(3) Description - Low level conduit to old turbine, not operative.

(4) Control Mechanism - Hand operated, geared gate, not operative.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No data on the design of the dam or appurtenances has been recovered and probably none exists.

2.2 Construction Data

No records or correspondence regarding construction have been found.

2.3 Operation Data

The dam is operated by Mr. Joseph Radwillowicz. There appear to be no formal records.

2.4 Evaluation Data

a. Availability. Since no engineering data is available, it is not possible to make an assessment of the safety of the dam. The basis of the information presented in this report is principally the visual observations of the inspection team.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General. The visual inspection of Manitook Lake Dam took place on 9 and 24 October, 1979. The discharge over the spillway was estimated to be about 3 cfs on 9 October 1979. There was considerable seepage from the downstream face of the masonry wall between the two buildings and a few other items require attention (see Section 7). The dam was judged to be in generally fair condition due to lack of maintenance and the lack of an operative low level outlet.

b. Dam. The dam is a composite structure (masonry and earth) with an overall length of 108 ft. It is 13.5 ft. high and retains a lake whose waters were once used for industrial purposes. Essentially, the dam consists of two masonry building foundations connected by an 18 ft. long wall at the downstream face of the dam, with an earth embankment upstream of the wall and foundations. The width of the crest varies, measuring about 25 ft. at its narrowest point. The two building foundations each support a building, one now used for storage and the other housing the Old Mill Village Store. The building and foundation on the left is about 40.5 ft. long and that on the right is about 50 ft. long. The wall connecting the two buildings is 18 ft. long. An asphalt paved driveway on the crest of the dam serves as access to the Old Mill Village Store. A small poured concrete cap exists along the upstream face of the dam near its crest and connects to a poured concrete outlet structure. There is a wooden post and rail fence along the upstream edge of the crest.

The 18 ft. long wall connecting the two buildings is in only fair condition because of a bulging section near the top 5 ft. and missing mortar (see Photograph No. 1). There was considerable seepage estimated to be about 20 gpm coming out of the downstream face of this wall at a point about 2 ft. right of the spillway.

The building foundations also serve as training walls for the spillway discharge channel. The training walls are of masonry with mortared joints. Both the right and left training walls were judged to be in only fair condition because they lack mortar in their joints.

There are two trees just downstream of the 18 ft. long wall on the right side of the spillway. One tree is about 6 in. diameter and one is about 2 in. diameter. There is also one 6 in. diameter tree located on the upstream face of the dam to the left of the spillway (see Photograph No. 2).

Photograph No. 3 shows the deteriorated condition of the building foundation located on the left side of the spillway discharge channel. Photograph No. 4 shows the pier supporting a corner of the building downstream of the spillway on the left side. This support seems to be undermined to some degree and is in poor condition.

c. Appurtenant Structures. The spillway is a concrete structure located in the 18 ft. long wall and adjacent to the building located on the left of the dam. The bottom of the spillway is 4 ft. wide, rising vertically 2.5 ft. and then widens out 0.5 ft. on the right and 1.5 ft. on the left to a full width of 6 ft. The 4 ft. wide section of the spillway is constructed to accommodate stop logs. At the time of the inspection, the spillway was equipped with stop logs rising to a height of 1.6 ft. Photograph No. 5 shows the spillway taken from the right side. Photograph No. 6 is a view of the spillway taken from downstream. The approach to the spillway is a 24 ft. long channel with concrete walls. The walls also serve as bridge seats for the wooden planking that crosses the approach channel.

On the upstream face of the dam there is a concrete wall which connects the right side of the approach channel to an inlet structure. This inlet structure, controlled by a gate (see Photograph No. 2), once provided water to a turbine located in the basement of the building on the right side. Photograph No. 7 shows the turbine taken from the downstream side. The size of the conduit leading to the turbine could not be determined and the inlet invert elevation is unknown. The gate mechanism shows no signs of maintenance in recent years and is presently inoperative due to a broken gate stem. The concrete between the gate structure and the spillway shows some erosion and cavitation to a depth of about 6 in.

d. Reservoir Area. The reservoir behind the dam is a ponding of an unnamed brook, extending upstream for a distance of about 6,500 ft. The shoreline of the reservoir appeared stable and no evidence of slides or other problems was noted.

The lake is used for recreational purposes and several houses are located along its western shore. There would probably be no damage to these houses owing to a rise of the water level within the surcharge space of the reservoir. However, the roadway carrying Routes 10 and 202 located just upstream from the dam crosses over the lake and would be flooded over by the test flood surcharge.

e. Downstream Channel. The unnamed brook below Manitook Lake Dam enters the East Branch of Salmon Brook about 300 ft. downstream of the dam. The East Branch of the Salmon Brook has a relatively wide, mostly uninhabited flood plain as it flows downstream to join the West Branch of Salmon Brook at point 2.65 miles downstream of the dam. At this point the brook becomes the Salmon Brook and continues on for another 1.7 miles, where it joins the Farmington River. This latter reach of the brook has a relatively wide and uninhabited flood plain.

3.2 Evaluation

In general, the visual inspection of the dam adequately revealed key characteristics of the project as they may relate to its stability and integrity, permitting an assessment to be made of those features affecting the safety of the structure. There was evidence of seepage in the wall connecting the two building foundations. Tree growth was noted both upstream and downstream of the spillway. The low level outlet to the turbine was found to be inoperative. In general the dam was judged to be in fair condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

Mr. Joseph Radwillowicz is the owner and operator of the dam. There is a low level outlet (leading to a turbine) which at the present time is not in operating condition. Stop logs are used except in spring to maintain the lake at a higher level. There are no documented operating procedures for the dam.

4.2 Maintenance of Dam

There is no maintenance program in effect at Manitook Lake Dam.

4.3 Maintenance of Operating Facilities

The existing low level outlet, which leads to the turbine and which possibly could be used for emptying the lake, is at the present time not maintained and inoperative. With the exception of the spillway stop logs there are no other operating facilities for the dam.

4.4 Description of any Warning System in Effect

No warning system is in effect at Manitook Lake Dam.

4.5 Evaluation

The only operational procedure at the dam is the annual removal and replacement of the spillway stop logs. There appears to have been little, if any, maintenance in recent years; it should include periodic growth removal from the embankment, surveillance regarding seeps and slope damage, repair and pointing of the masonry walls. A formal warning system should be established.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. Manitook Lake Dam is a masonry stone wall dam with an upstream earth fill impounding a normal storage of about 304 acre-ft. with provision for an additional 363 acre-ft. of capacity in its surcharge space to the top of dam. It is basically a low surcharge-low spillage facility originally used for industrial purposes. The original purpose of the dam has been abandoned and a store and warehouse now occupy the premises on the dam. The impounded water is now used for recreational purposes. The spillway is capable of discharging about 100 cfs with surcharge to the top of dam. The general characteristics of the 1.53 sq. mi. (979 acres) drainage basin is best described as rolling terrain. The drainage area measures about 2.1 mi. long and 1.2 mi. wide and rises from elevation 194.0 at the spillway crest to elevation 638 MSL. The area is generally forested, with some open fields and medium density housing.

b. Design Data. There is no design data available for Manitook Lake Dam.

c. Experience Data. No records are available in regard to past operation of the dam, nor of surcharge encroachments and spills through the spillway. The maximum past inflows are unknown. About 300 ft. downstream of the dam the unnamed brook leading from the dam joins the East Branch of Salmon Brook. U.S.G.S. Gaging Station 01189390 is located about 2.2 mi. downstream of the dam. According to U.S.G.S. Water Supply Papers, the maximum discharge at the gage site between October 1963 and September 1976 occurred on September 26, 1975 when the discharge was 1,940 cfs.

d. Visual Observations. There are no present evidences either along the reservoir or in the downstream channel to indicate high water levels or signs of major spillway outflows. No one contacted could recollect any such occurrences.

e. Test Flood Analysis. Reservoir area and capacity curves and tables for use in flood routing are shown on Sheets D-2 and D-3, Appendix D. For determining surface areas and surcharge capacities, planimetered areas were taken from contours delineated on U.S.G.S. 2,000 ft. per in. quadrangle sheets.

The test flood chosen to evaluate the hydrologic and hydraulic capacity of Manitook Lake was selected in accordance with the criteria presented in the Recommended Guidelines for Safety Inspection of Dams. Since this dam is classified as small in size with a significant hazard potential, the range of recommended test floods is of a magnitude corresponding to 100 year to ½ PMF. Because of the two commercial buildings that are located on the dam, a test flood of ½ PMF was selected for the evaluation.

Precipitation data were obtained from Hydrometerological Report No. 33, which for the Connecticut area approximates 24.0 in. of 6-hour point rainfall over a 10 square mile area. This value was then reduced by 20 percent to allow for basin size, shape and fit factors. The 6-hour rainfall was distributed into

one hour incremental periods as suggested in COE Publication EC 1110-2-1411. A constant loss factor of 0.4 in. was deducted from the precipitation value to give excess rainfall used to prepare an inflow hydrograph.

A triangular incremental unitgraph was assumed for the inflow hydrographs, using a computed lag time value of 1.68 hours to derive a time-to-peak for the triangular hydrograph of 1.79 hours (see computations on Sheets D-7 thru D-9, Appendix D). A PMF inflow hydrograph is shown on Sheet D-10, Appendix D indicating a peak inflow of 4,500 cfs. The peak value was ther divided by 2 to arrive at the test value of 2,250 cfs or 1,470 CSM.

Discharge tables and curves for the spillway and for over the top of the dam are shown on Sheets D-4 thru D-6, Appendix D.

A flood routing was performed for the test flood, which is summarized below.

Test Flood Magnitude	Test Flood Inflow cfs	Max. Res. El. ft. MSL	Max. Head Over Dam Ft.	Routed Test Flood Outflow cfs
½ PMF	2,250	199.37	1.77	1,580

From the above table, it can be seen that the project will not pass the routed test flood outflow without overtopping the top of the dam by 1.77 ft. The project can handle only about 6 percent of the routed test flood outflow without overtopping the dam.

It should be noted that the roadway crossing which carries Routes 10 and 202 across the lake and which is located just upstream of the dam will have some effect on the test flood inflow at the dam. This factor was not taken into consideration in the analysis because of the high tailwater downstream of the culvert crossing. It is estimated that the Routes 10 and 202 roadway will begin to flood over when the discharge passing through the culvert is slightly less than 500 cfs and that the head differential between the two sides of the road will be less than 0.5 ft. (see Sheet D-19, Appendix D).

f. Dam Failure Analysis. As discussed above, the dam would be overtopped by the routed test flood outflow. Also, a breach of the dam owing to structural failure or by piping is a possibility. For this analysis a breach was assumed with the water level at the top of dam. The "rule of thumb" criteria suggested in the NED March 1978 Guidance Report was used for the failure analysis. With a breach width of 40 percent of the dam length or 43 ft., an outflow of about 3,580 cfs would be realized. It was assumed that the section which failed included the spillway section; thus, the total outflow was assumed to be 3,580 cfs.

It should be noted that if the dam failed and the roadway carrying Routes 10 and 202 across the lake did not fail, the culvert under the roadway and the embankment carrying the road would have a retarding effect on the breach discharge. In this analysis it was assumed that the roadway also failed as a result of the breaching of the dam.

About 300 ft. downstream of the dam the unnamed brook coming from Manitook Lake joins the East Branch of Salmon Brook. The East Branch of Salmon Brook in this area has a relatively wide flood plain; its width extends to a maximum of about 1,500 ft. at a point about 600 ft. downstream of the dam. In general the valley is relatively wide for its entire length as it joins the West Branch of Salmon Brook at a point 2.65 miles below the dam and then continues on as the Salmon Brook for another 1.7 miles until joining the Farmington River. The only exception to the above is at four roadway crossings and a railway crossing. The wide valleys described above will tend to dampen rather quickly a sudden surge from the breached dam.

It is estimated that a breach would cause about a 5 ft. rise in water surface elevation at a point 3,000 ft. downstream of the dam, and a rise of about 2 ft. at point 8,000 ft. downstream of the dam. At U.S.G.S. Gaging Station 01189390 located just downstream of the highway bridge on State Route 20, it is estimated that the flood stage would be about 8.6 ft., or at elevation 169.3, somewhat higher than bank full. No further damages would be anticipated below this point.

A sudden breach of the dam would result in the loss of the two commercial buildings located on and adjacent to the dam and would probably cause damage to one house and two other structures located just upstream of the U.S.G.S. gaging station. In addition, the embankment carrying Routes 10 and 202 immediately upstream of the dam would probably be washed out.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation. There are no design calculations, as-built drawings or other data which would permit the preparation of structural stability computations based on assumed soil properties and engineering factors. The dam is now stable but deficiencies described under Section 7 should be corrected. The field investigation revealed no significant displacements of the dam, with the exception of the slight bulge in the downstream face of the masonry rubble wall, which is attributable to the original method of construction and not to post construction movement.

b. Design and Construction Data. No plans or calculations of value to a stability assessment are available for the dam which was constructed around 1900.

c. Operating Records. There are no records which indicate the manner in which the dam has been operated.

d. Post Construction Changes. There are no records of any post construction changes made to the dam over the course of its history. The rail fence is of recent construction and serves as a safety barricade.

e. Seismic Stability. The dam is located in seismic Zone No. 1 and in accordance with recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the Phase I visual examination, Manitook Lake Dam appears to be in fair condition. The dam has no operative dewatering facility and some items are in need of repair, maintenance, and continual observation. The major concerns with the overall integrity of the dam are as follows:

(1) The spillway will only pass about 6 percent of the routed test flood outflow.

(2) The lack of an operating facility for drawing down the reservoir.

(3) Seepage at the downstream toe of the 18 ft. long wall connecting the two commercial buildings.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency. The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

d. Need for Additional Investigations. Additional investigations are required as recommended in Para. 7.2.

7.2 Recommendations

It is recommended that the owner, Mr. Joseph Radwillowicz, should retain the services of a registered professional engineer experienced in the design of dams to make further investigations of the following, and should implement the results:

(1) Make a thorough study of the hydrology of the drainage basin and evaluate further the potential for overtopping and the adequacy of the spillway.

(2) Study the feasibility of putting the turbine gate back into operation and using this facility as a means to safely drain the lake.

(3) Determine the cause of seepage at the downstream side of the 18 ft. long wall connecting the two commercial buildings and recommend methods of repair. Monitor this seepage at least every 3 months until the engineering study is completed.

(4) Review the use of stoplogs on the spillway crest and determine the feasibility of either eliminating their use altogether or modifying them to facilitate quick removal in anticipation of a storm.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

(1) Remove two small trees at the base of the dam just downstream of the spillway, and one tree on the upstream face of the dam.

(2) Repoint missing mortar in joints of masonry wall and building foundations adjacent to the spillway.

(3) Develop a formal surveillance and flood warning plan, including round-the-clock monitoring during period of heavy rainfall.

(4) Institute procedures for an annual periodic technical inspection of the dam and its appurtenant structures.

7.4 Alternatives

There are no meaningful alternatives to the above recommendations and remedial measures.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Manitook Lake Dam

DATE 9 and 24 October 1979

TIME 9:30 AM

WEATHER Cloudy/Overcast

W.S. ELEV. 195.3 U.S. DN.S.

PARTY:

1. Pasquale E. Corsetti	LBA*	6.	
2. Roger F. Berry	LBA	7.	
3. William S. Zoino	GZD	8.	
4. Peter B. Dyson	LBA	9.	
5. Carl J. Hoffman	LBA	10.	

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydrologic	Roger F. Berry	
2.	Hydraulic/Structural	Carl J. Hoffman	
3.	Soils and Geology	William S. Zoino	
4.	General Features	Peter B. Dyson	
5.	General Features	Pasquale E. Corsetti	
6.			
7.			
8.			
9.			
10.			

*LBA - Louis Berger & Associates, Inc.
GZD - Goldberg, Zoino, Dunnicliff & Assoc., Inc.

PERIODIC INSPECTION CHECKLIST

PROJECT Manitook Lake Dam DATE 9 and 24 October 1979

PROJECT FEATURE Dam Embankment & Wall NAME

DISCIPLINE Soils and Geology NAME William S. Zoino

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	197.6
Current Pool Elevation	195.3
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	Fair
Movement or Settlement of Crest	Some
Lateral Movement	Bulge in 18 ft. masonry wall, probably existed in original construction.
Vertical Alginment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	None
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	None
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	N.A.
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	Yes. About 2 ft. right of spillway at toe, rate about 20 gpm.
Piping or Boils	None
Foundation Drainage Features	None evident
Toe Drains	None evident
Instrumentation System	None evident

PERIODIC INSPECTION CHECKLIST

PROJECT Manitook Lake Dam DATE 9 and 24 October 1979

PROJECT FEATURE Spillway Approach Channel NAME

DISCIPLINE Structural NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Vertical concrete walls
Bottom Conditions	Heavy silt
Rock Slides or Falls	None
Log Boom	N.A.
Debris	None
Condition of Concrete Lining	Poor to Fair - spalling
Drains or Weep Holes	None evident
b. Intake Structure	
Condition of Concrete	Poor
Stop Logs and Slots	Yes. 1.6 ft. high in spillway.

PERIODIC INSPECTION CHECKLIST

PROJECT Manitook Lake Dam DATE 9 and 24 October 1979

PROJECT FEATURE Spillway NAME

DISCIPLINE Hydraulics/Structures NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	One
Floor of Approach Channel	Heavily silted
b. Weir and Training Walls	
General Condition of Concrete	Poor to fair
Rust or Staining	Yes
Spalling	Yes
Any Visible Reinforcing	No
Any Seepage or Efflorescence	Yes
Drain Holes	None evident
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Yes
Floor of Channel	Remnants of a timber crib
Other Obstructions	Some debris in channel

PERIODIC INSPECTION CHECKLIST

PROJECT Manitook Lake Dam DATE 9 and 24 October 1979

PROJECT FEATURE Turbine Outlet NAME

DISCIPLINE Hydraulic/Structural NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Fair
Rust or Staining	None
Spalling	Yes
Erosion or Cavitation	Yes
Visible Reinforcing	No
Any Seepage or Efflorescence	No
Condition at Joints	N.A.
Drain Holes	None evident
Channel	Natural Pond
Loose Rock or Trees Overhanging Channel	None
Condition of Discharge Channel	Good

PERIODIC INSPECTION CHECKLIST

PROJECT Manitook Lake Dam DATE 9 and 24 October 1979

PROJECT FEATURE Spillway Bridge NAME

DISCIPLINE Structural NAME Carl J. Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SERVICE BRIDGE	
a. Superstructure	N.A.
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Underside of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	Fair
Alignment of Abutment	Good
Approach to Bridge	Good
Condition of Seat and Backwall	N.A.

NOTE: Bridge is a wooden planked bridge which spans the spillway approach channel - condition fair.

PERIODIC INSPECTION CHECKLIST

PROJECT: Manitook Lake Dam DATE: 9 and 24 October 1979

AREA EVALUATED	CONDITION
Outlet Works Control Tower	N.A.
Outlet Works Transition and Conduit	N.A.
Dike Embankment	N.A.

APPENDIX B

ENGINEERING DATA

No. [illegible] 15

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

Inventoried By I C

Date 5-28-63

CT 672
LAT. 41°58.1'
LONG. 72°41.7'

Name of Dam or Pond [illegible]

Code No. F17.15 S5.0

Nearest Street Location [illegible]

Town [illegible]

U.S.G.S. Quad. [illegible]

Name of Stream [illegible]

Owner [illegible] JOS. R. RADWILLOWICZ SOUTHWICK, MASS

Address [illegible]

[illegible]

Pond Used For [illegible] REC. OA 1.595M

Dimensions of Pond: Width _____ Length _____ Area 85 acres

Total Length of Dam 30' Length of Spillway 10'

Location of Spillway C.S.

Height of Pond Above Stream Bed [illegible]

Height of Embankment Above Spillway 2'

1900? Type of Spillway Construction Concrete

Type of Dike Construction Concrete

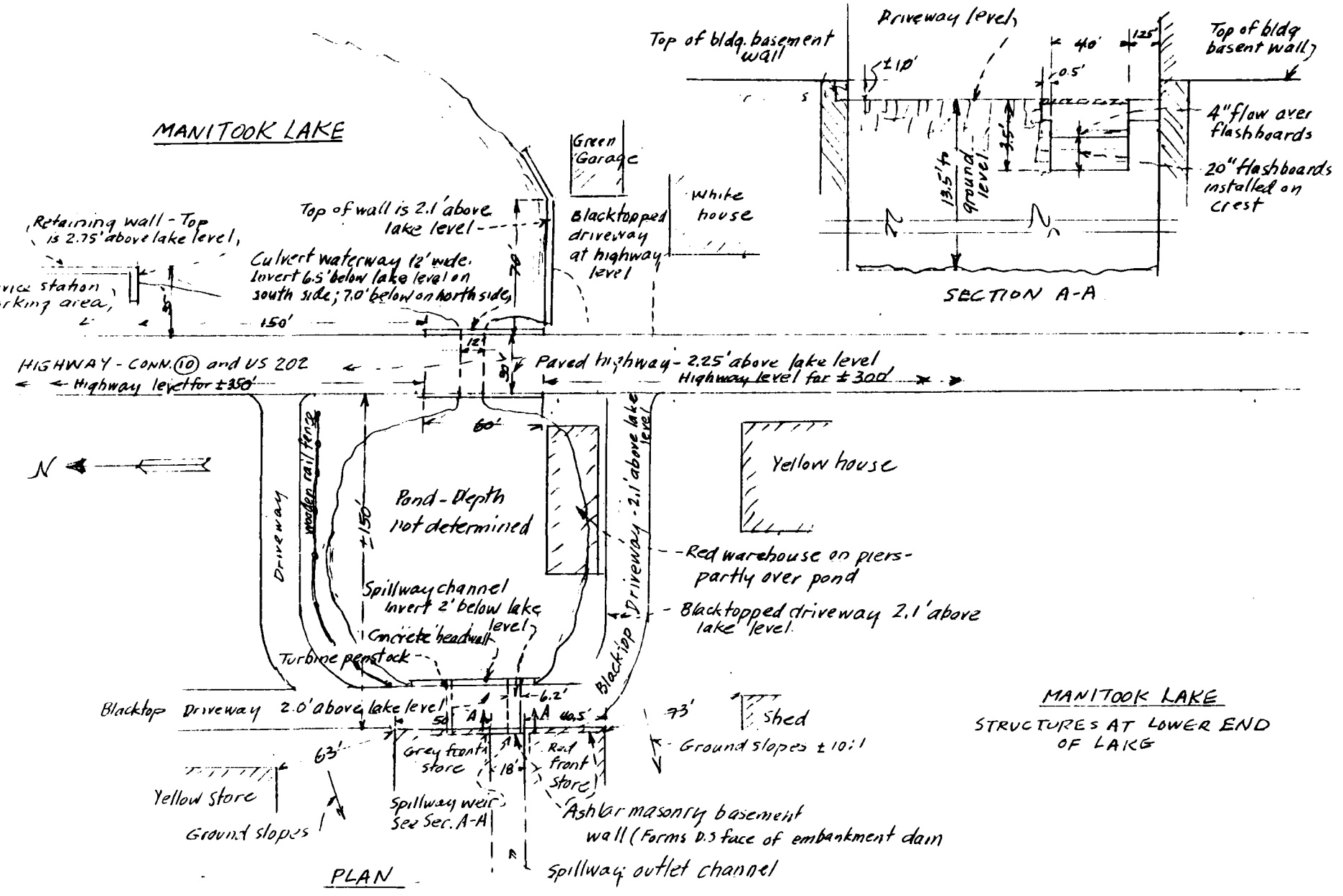
Downstream Conditions Road & Bldg 200'

Summary of File Data

Remarks [illegible]

[illegible]

Would Failure Cause Damage? Yes Class B



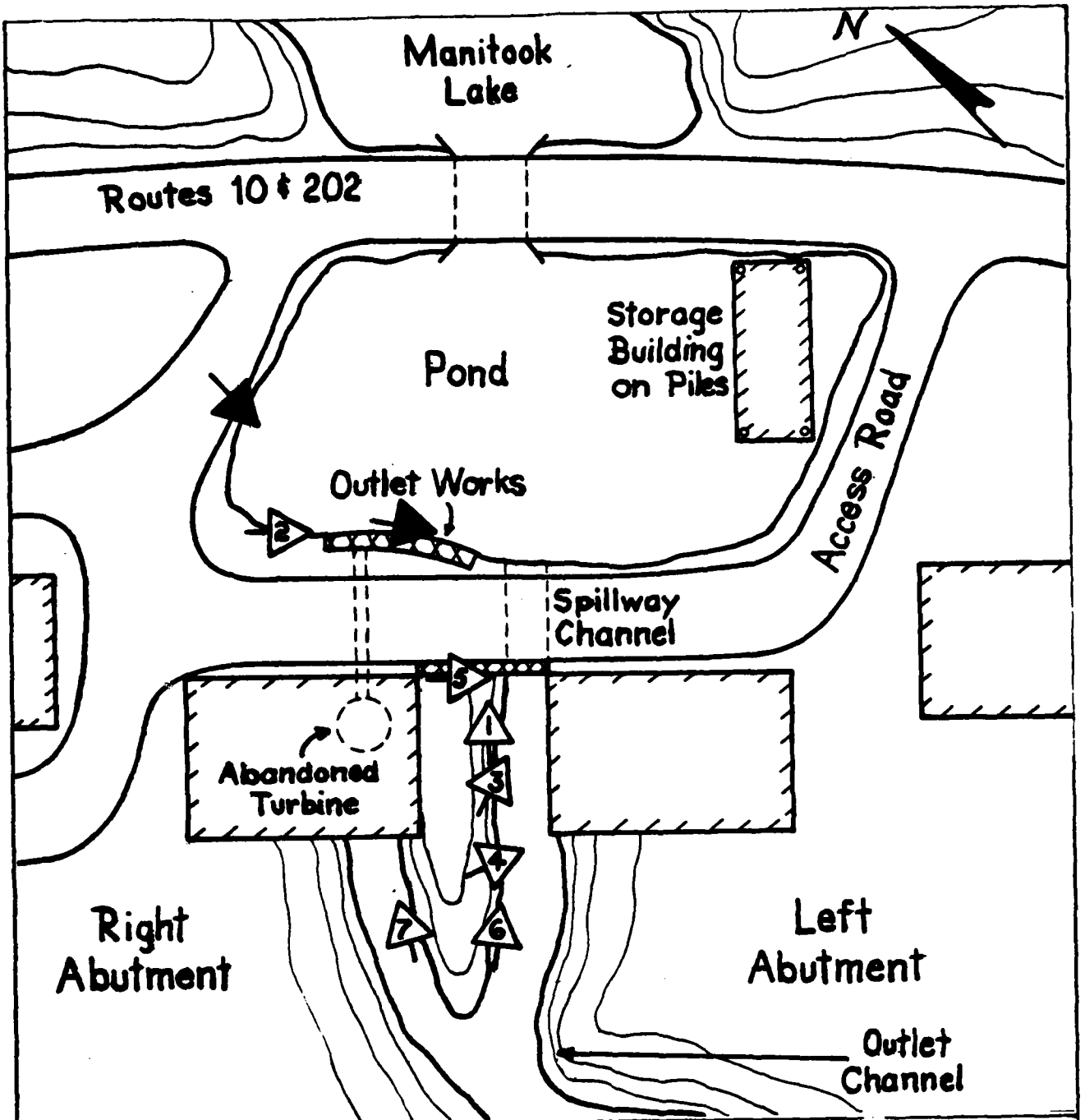
MANITOOK LAKE

STRUCTURES AT LOWER END OF LAKE

Appendix B

APPENDIX C

PHOTOGRAPHS



Appendix 'C' Photos →

Overview Photos →

Not to Scale

LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MANITOOK LAKE DAM

SKETCH PLAN SHOWING LOCATION & ORIENTATION OF PHOTOS

STATE - CT.

			SCALE
			DATE

1. Bulging downstream face of 18 ft. long masonry wall

2. Inoperative outlet valve and 6 in. dia. tree on upstream face of dam.

3. Deteriorated building foundation along left side of spillway outlet channel.

4. Deteriorated building pier immediately downstream of spillway.

5. Spillway outlet from right training wall.

6. Spillway outlet from downstream channel.

7. Abandoned turbine.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

BY JKH DATE 4/5/79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF 1

CHKD. BY ____ DATE ____ INSPECTION OF DAMS - CONN & RI PROJECT ____

SUBJECT MANITOOK LAKE - DRAINAGE AREA

FIND : ENTIRE AREA ABOVE LAKE

PLANIMETER No. 3651-30
INDEX @ 39.9
1.0 = 1 sq. in.

U.S.G.S Sheet	Ave Reading (sq. in.)
Tariffville, Conn., Mass.	10.66

Scale: $(1")^2 = (2{,}000')^2$ $\quad 4{,}000{,}000$ sq ft/sq. in.

$$\text{Area} = \frac{10.66 \text{ sq in} \times 4 \times 10^6 \text{ sq ft/sq in}}{43{,}560 \text{ sq ft/Acre}} = \boxed{978.88 \text{ Acres}}$$

$$978.88 \text{ Acres} \div 640 \text{ Acres/sq. mi.} = \boxed{1.53 \text{ sq. mi.}}$$

BY RFB DATE 12-16-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF ...
CHKD. BY ... DATE ... INSPECTION OF DAMS PROJECT ...
SUBJECT MANITOOK LAKE, STORAGE CAPACITY DATA

AREA AT WATER SURFACE LEVEL, ELEV. 194

READ #2 79.38 READ #3 79.98 AREA = 0.61 □"
READ #1 78.76 " #2 79.38 " = 92 ACRES
.62 .60

AREA AT ELEV. 200

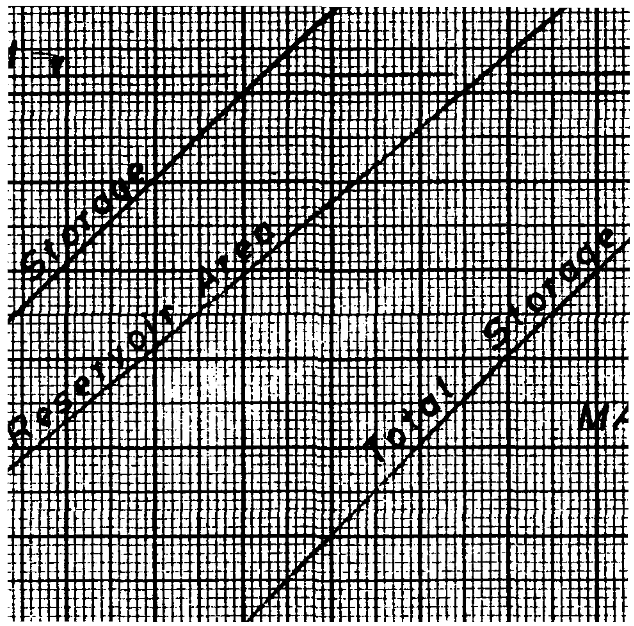
READ #2 81.20 READ #3 82.52 AREA = 1.32 □"
" #1 79.88 " #2 81.20 " = 121 ACRES
1.32 1.32

VOLUME @ SPILLWAY CREST, ELEV 194, H = 13.5 - 3.6 = 9.9'

$V = 1/3\, h\,(b_1 + b_2 + \sqrt{b_1 b_2}) = 1/3\,(9.9)(92)$

V = 304 ACRE-FT, FROM OLD DAM INVENTORY 510 ACRE-FT

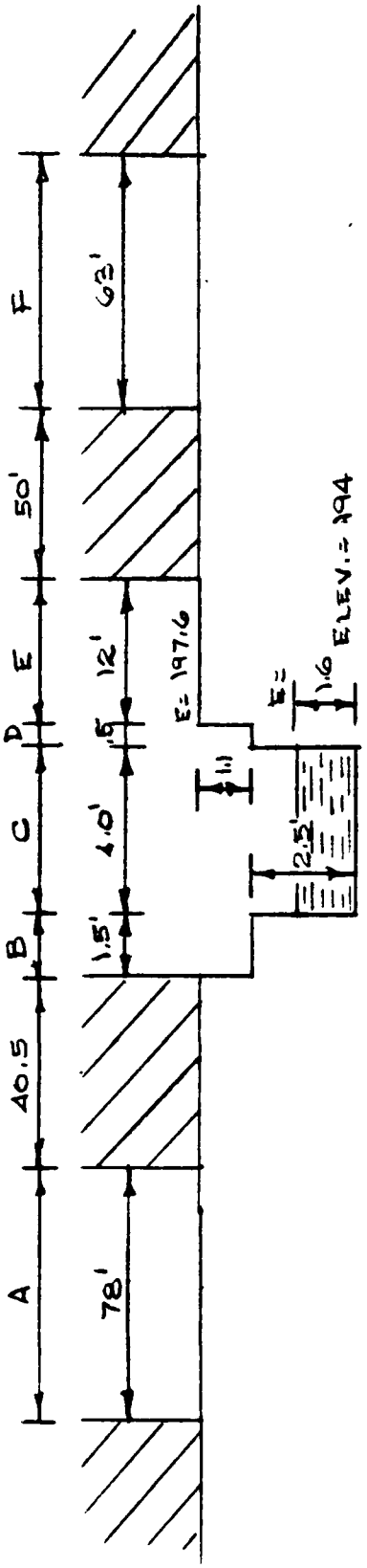
ELEV.	AREA	$\overline{\text{AREA}}$	ΔH	Δ STORAGE	TOTAL STORAGE	SURCHARGE STORAGE
194	92		1		304	0
195	96.8	94.4	1	94.8	399	95
196	101.7	99.2	1	99.2	498	194
197	106.5	104.1	1	104.1	602	298
198	111.3	108.9	1	108.9	711	407
199	116.2	113.8	1	113.8	825	521
200	121	118.6	1	118.6	943	639


Storage
Reservoir Area
Total Storage

BY RFB DATE 10-10-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT MANITOOK LAKE, DISCHARGE CAPACITY



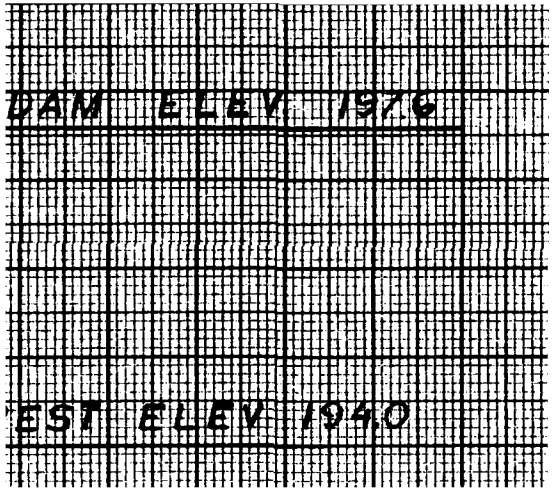
ELEV FT	A C=2.5 L	A C=2.5 H	A C=2.5 Q	B C=3.1 L	B C=3.1 H	B C=3.1 Q	C C=3.3 L	C C=3.3 H	C C=3.3 Q	D C=3.2 L	D C=3.2 H	D C=3.2 Q
195	78	0	0	1.5	0	0	4	1	13	0.5	0	0
196		0	0		0	0		2	37		0	0
196.5		0	0		0	0		2.5	52		0	0
197		0	0		.5	2		3	69		1.5	1
197.6		0	0		1.1	5		3.6	90		1.1	2
198		.4	49		1.5	8		4	106		1.5	3
199		1.4	323		2.5	18		5	148		2.5	6
200		2.4	725		3.5	30		6	194		3.5	10
201		3.4	1125		4.5	44		7	244		4.5	15
202		4.4	1799		5.5	60		8	297		5.5	21

BY RFB DATE 10-10-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF ...

CHKD. BY ..... DATE ..... INSPECTION OF DAMS PROJECT .....

SUBJECT MANITOOK LAKE, DISCHARGE CAPACITY

ELEV. FT.	E C=2.8 L	E C=2.8 H	E C=2.8 Q	F C=2.5 L	F C=2.5 H	F C=2.5 Q	TOTAL Q
195	12	0	0	63	0	0	13
196		0	0		0	0	37
196.5		0	0		0	0	52
197		0	0		0	0	71
197.6		0	0		0	0	97
198		.4	8		.4	40	214
199		1.4	57		1.4	260	812
200		2.4	125		2.4	586	1670
201		3.4	210		3.4	987	2625
202		4.4	310		4.4	1453	3940


DAM ELEV 1976
EST ELEV 1940

BY RFB DATE 9-7-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ INSPECTION OF DAMS PROJECT ____

SUBJECT MANITOOK LAKE, INFLOW HYDROGRAPH

DRAINAGE AREA TOTAL = 1.53 SQ MI = 979 ACRES

WATER SURFACE < 25% TOTAL DRAINAGE AREA

ALL OVERLAND RUNOFF

NOW LENGTH OF LONGEST WATER COURSE, L = 6300 FT
= 1.19 MI

$\frac{1}{4}$ ELEV DIFFERENCE = 638 - 194 = 444 FT

$\therefore$ SLOPE = $\frac{444}{1.19}$ = 373 FT/MI $\frac{1}{4}\sqrt{S}$ = 19.32

NOW $\frac{LLc}{\sqrt{S}} = \frac{(1.19)(1.19)}{(2)(19.32)} = 0.0366$

$\left(\frac{LLc}{\sqrt{S}}\right)^{.33} = (0.0366)^{.33} = 0.336$

LAG = $K\left(\frac{LLc}{\sqrt{S}}\right)^{.33} = 0.336\,K$ ASSUME K = 5.0 HRS (REFERS TO CURVE 3" MOUNTAINOUS RUGGED, MIXED TERRAIN, E OF REC)

LAG = 0.336 (5) = 1.68 HRS

$T_p = 0.41D + 0.53\,LAG$, WHERE D = 1.0 HRS

$T_p = 0.41(1) + 0.52(1.68) = 0.41 + 1.38 = 1.79$ HRS

CHECK VELOCITY $T_c = \frac{T_p - 0.5D}{0.6} = 2.15$ HRS

$V = \frac{L}{T_c \times 3600} = \frac{6600}{2.15(3600)} = 0.52$ FPS OK

$T_R = 1.67\ T_p = 1.67\ (1.79) = 2.99$ HRS

$T_B = T_p + T_R = 1.67 + 2.99 = 4.66$ HRS

---

q_p = PEAK RATE IN CFS

$$q_p = \frac{484\ A\ Q}{T_p}$$

A = DRAINAGE AREA
Q = RUNOFF IN INCHS

$$q_p = \frac{484\ (1.53)\ (1)}{1.79} = 414$$

PMP = PROBABLE MAXIMUM PRECIPITATION

= (24") (.8) = 19.2" FOR CONNECTICUT

= 18.8" CONSIDERING INFILTRATION FOR OVERLAND FLOW.

BY RFE DATE 9-7-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. ____ OF ____

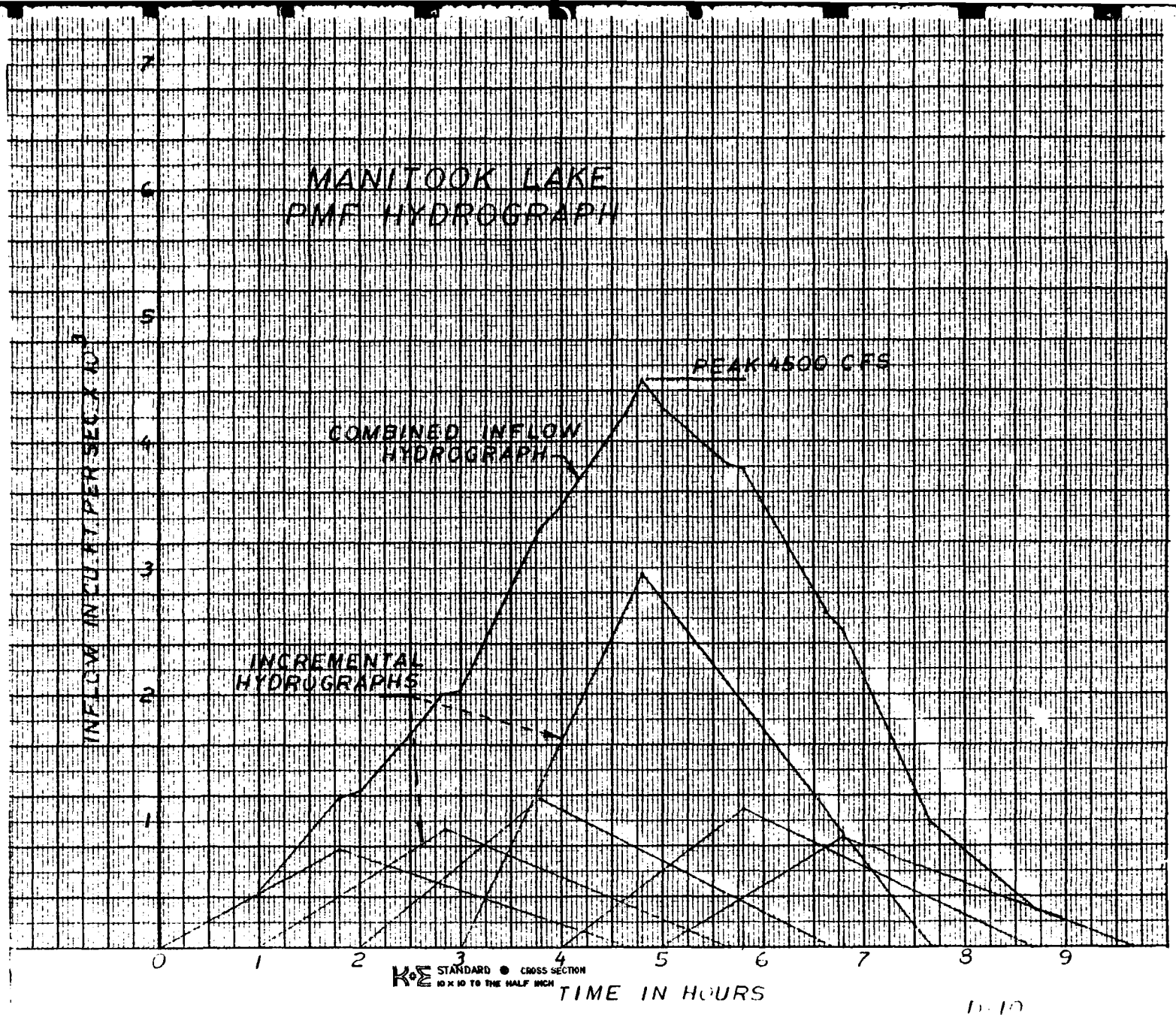
CHKD. BY ____ DATE ____ INSPECTION OF DAMS PROJECT ____

SUBJECT MANITOCK LAKE, INFLOW HYDROGRAPH

FLOOD HYDROGRAPH FOR PMF q = 414

TIME (HOURS)	RAINFALL * %	RAINFALL INCHES	Q CFS	TIME BEGIN	TIME PEAK	TIME END
0.0	-					
1.0	10	1.88	778	0	1.79	4.66
2.0	12	2.26	936	1.0	2.79	5.66
3.0	15	2.82	1167	2.0	3.79	6.66
4.0	38	7.14	2956	3.0	4.79	7.66
5.0	14	2.63	1089	4.0	5.79	8.66
6.0	11	2.07	857	5.0	6.79	9.66

* DISTRIBUTION OF MAXIMUM 6 HOUR SPS = PMP IN PERCENT OF 6 HOUR AMOUNT PER EM 1110-2-1411


MANITOOK LAKE
PMF HYDROGRAPH
PEAK 4600 CFS
COMBINED INFLOW HYDROGRAPH
INCREMENTAL HYDROGRAPHS
INFLOW IN CU FT PER SEC X 10³
TIME IN HOURS
0
1
2
3
4
5
6
7
8
9
K&E STANDARD CROSS SECTION
10 X 10 TO THE HALF INCH

BY RFB DATE 10-16-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE Inspection of Dams PROJECT

SUBJECT Manitook Lake - Reservoir Routing

Drainage Area = 1.53 sq.mi. = 979 acres

Max Storage = 667 acre.ft

Height = 13.5 ft.

Size Classification = Small

Hazard Classification = Significant

Test Flood = 100 yr to ½ PMF

Try ¼ PMF = 100yr = ¼(4500) = 1125 cfs

Step 1 Q_{p_1} = 1125 cfs

Step 2 a. Surcharge Height = 199.42

b. Volume of Surcharge = 570 acre.ft

$$Stor_1 = \frac{570 \text{ Acre.ft}}{979 \text{ Acres}} \times 12 = 6.99 \text{ inches}$$

c. $$Q_{p_2} = Q_{p_1} \times \left(1 - \frac{6.99}{4.25}\right) \therefore Q_{p_1} = 0$$

Use ½ PMF = 2250 cfs

Step 2 a. Surcharge Height = 200.69

b. Volume of Surcharge = 720 Acre.ft

$$Stor_1 = \frac{720}{979} \times 12 = 8.82 \text{ inches}$$

STEP 2 : $Q_{P2} = Q_{P1} \times \left(1 - \frac{8.82}{9.3}\right) =$

$Q_{P2} = 2250\,(1 - 0.928)$

$Q_{P2} = 2250\,(.072) = 162$

STEP 3 a SURCHARGE HEIGHT = 198

STORAGE = 405 ACRE·FT

$STOR_2 = \frac{405 \text{ ACRE·FT}}{979 \text{ ACRES}} \times 12 = 4.96 \text{ INCHS}$

b $STOR_{AVE} = \frac{8.82 + 4.96}{2} = 6.89 \text{ INCHS}$

$\frac{6.89 \times 979}{12 \text{ IN/FT}} = 562 \text{ ACRE·FT}$

ELEV @ 562 ACRE·FT = 199.37

@ 199.37 FT $Q_{P3} = 1580$ CFS

SPILLWAY INADEQUATE TO PASS ½ PMF

OVERTOPPING BY 199.37 − 197.6 = 1.77 FT

BY RFB DATE 10-16-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT MANITOOK LAKE, FAILURE ANALYSIS

USE RULE OF THUMB METHOD

STEP 1 RESERVOIR STORAGE @ TIME OF FAILURE IS 667 ACRE-FT

STEP 2 $Q_{P1} = 8/27\ W_b \sqrt{g}\ Y_o^{3/2}$

W_b = 40% of 109 = 43 FT

Y_o = 13.5 FT

$Q_{P1} = 1.68\ (43)(13.5)^{3/2}$

Q_{P1} = 3584 CFS

ASSUME SPILLWAY SECTION WASHED OUT

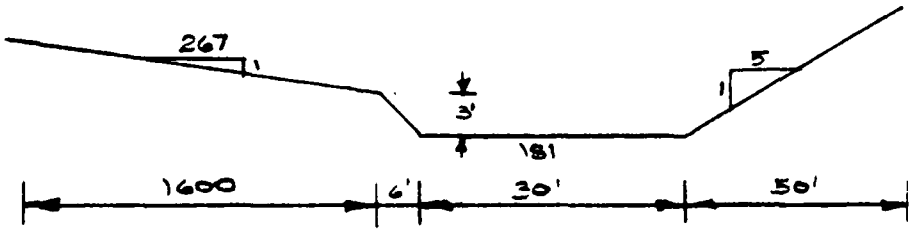
SAY TOTAL Q_{P1} = 3580 CFS

REACH 1 $n = 0.090$ $S = \frac{10}{1600} = .0062$

L = 3000 FT $S^{1/2} = .047$

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$Q = 0.78\ A R^{2/3}$

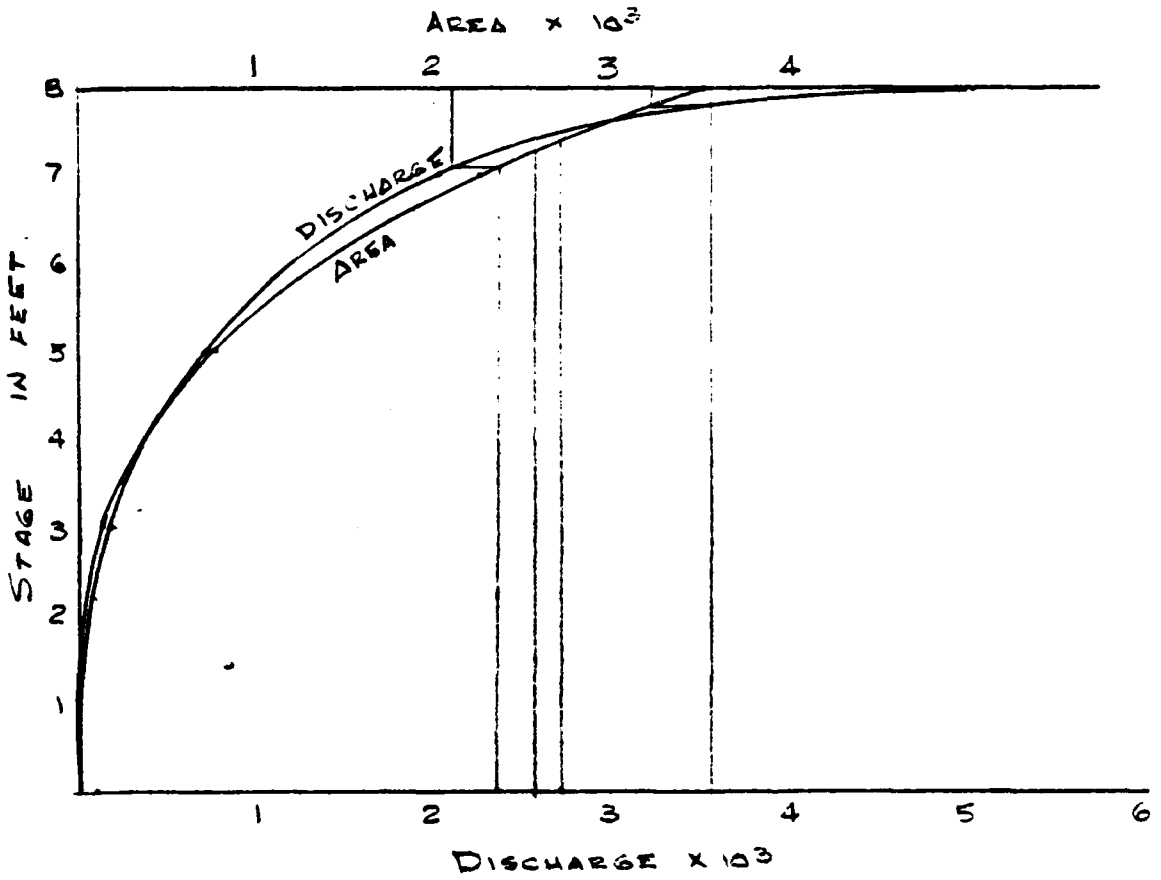


BY RFB DATE 10-17-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT MANITOOK LAKE, FAILURE ANALYSIS

STAGE	ΔAREA	AREA	P	R	$R^{2/3}$	Q
3	122	122	52	2.35	1.77	168
5	646	768	596	1.29	1.19	707
7		2278	1140	2.00	1.59	2825
8		3522	1412.5	2.49	1.84	5055



REACH 1, L = 3000

Q_{P_1} = 3580, STAGE = 7.8', AREA = 3250

$$Y_1 = \frac{3250 \times 3000}{43{,}560} = 224 \text{ ACRE-FT}$$

$Y_1 < \frac{1}{2}S = 334$ ACRE-FT

$Q_{P2}\ (TRIAL) = Q_{P1}\left(1 - \frac{V_1}{S}\right)$

$= 3580\left(1 - \frac{224}{667}\right) = 3580\ (1 - 0.336)$

$= 2377$ CFS

FOR $Q = 2377$, STAGE = 7.1 AREA = 2110

$V_2 = \frac{2110 \times 3099}{43{,}560} = 145$ $\quad V_{AVE} = \frac{V_1 + V_2}{2}$

$V_{AVE} = 184$

$Q_{P2} = 3580\left(1 - \frac{184}{667}\right) = 3580\ (1 - 0.276)$

$Q_{P2} = 2591$ $\quad$ STAGE = 7.3 FT

$Q_{SPILLWAY} = 100$ $\quad$ STAGE = 2.2 FT

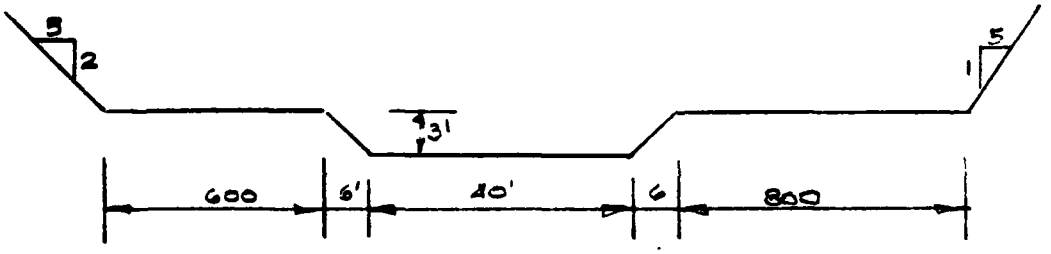
$\Delta H = 5.1$ FT

REACH 2
L = 6000

$n = 0.075$ $\quad S = \frac{10}{6000}$

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$ $\quad S = .0017$

$Q = 0.81\ A R^{2/3}$ $\quad S^{1/2} = .041$

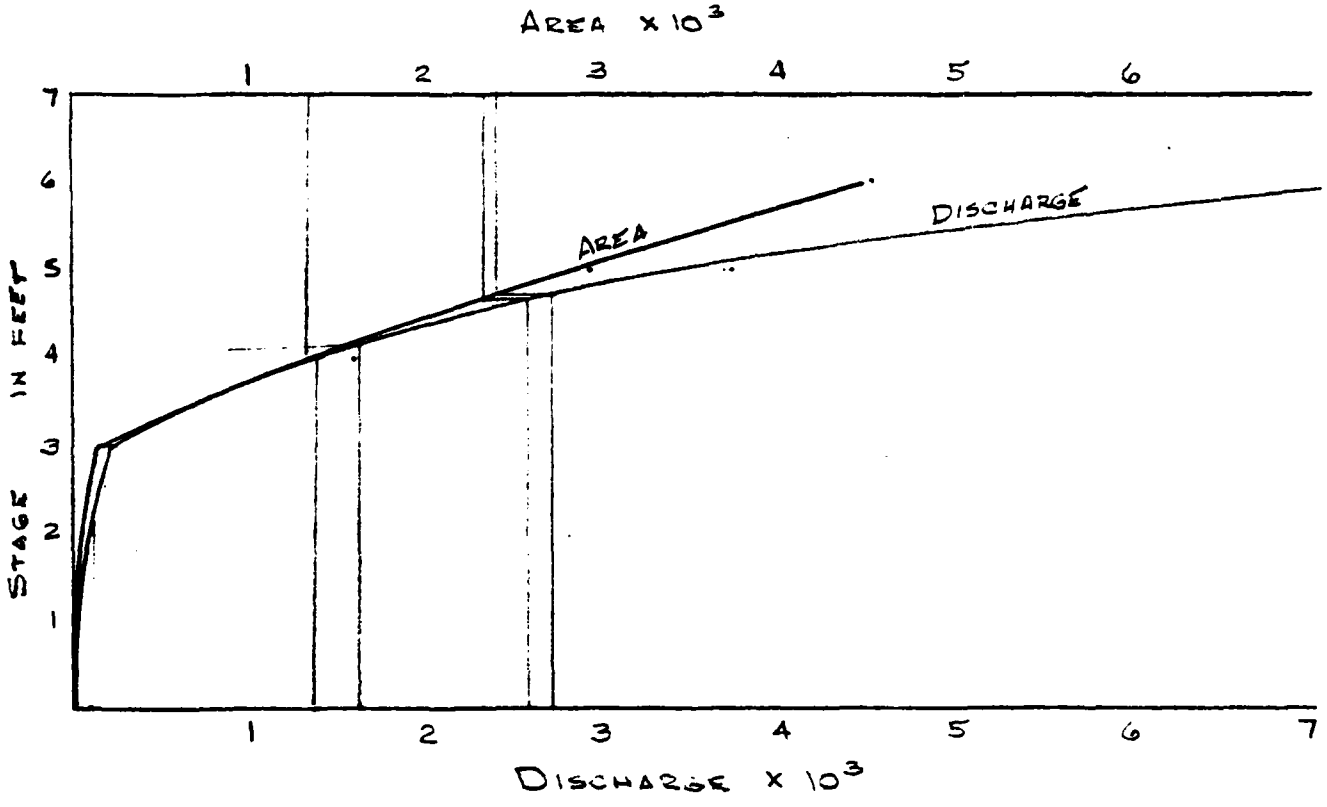


BY RFB DATE 10-17-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 4 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT MANITOOK LAKE, FAILURE ANALYSIS

STAGE	Δ AREA	AREA	P	R	$E^{2/3}$	Q
3	138	138	53.4	2.58	1.88	210
4	1456	1594	1461	1.09	1.06	1369
5		2919	1468	1.99	1.58	3736
6		4528	1476	3.07	2.11	7739



REACH 2, L = 6000

Q_{P_1} = 2591 STAGE = 4.7, AREA = 2320

$$V_1 = \frac{2320 \times 6000}{43{,}560} = 320 \text{ ACRE-FT}$$

$V_1 < \frac{1}{2} S = .334$

$$Q_{P_2}\ (\text{TRIAL}) = Q_{P_1}\left(1 - \frac{V_1}{S}\right)$$

$$= 2591\left(1 - \frac{320}{667}\right) = 2717\left(1 - 0.479\right)$$

$$= 1348$$

FOR $Q = 1348$, STAGE = 4.0, AREA = 1333

$$V_2 = \frac{1333 \times 6000}{43560} = 184$$

$$V_{AVE} = \frac{320 + 184}{2} = 252 \text{ ACRE-FT}$$

$$Q_{P2} = 2591\left(1 - \frac{252}{667}\right) = 1612$$

FOR $Q = 1612$ STAGE = 4.2

FOR SPILLWAY $Q = 100$ STAGE = 2.2

$\Delta H = 2.0$ FT

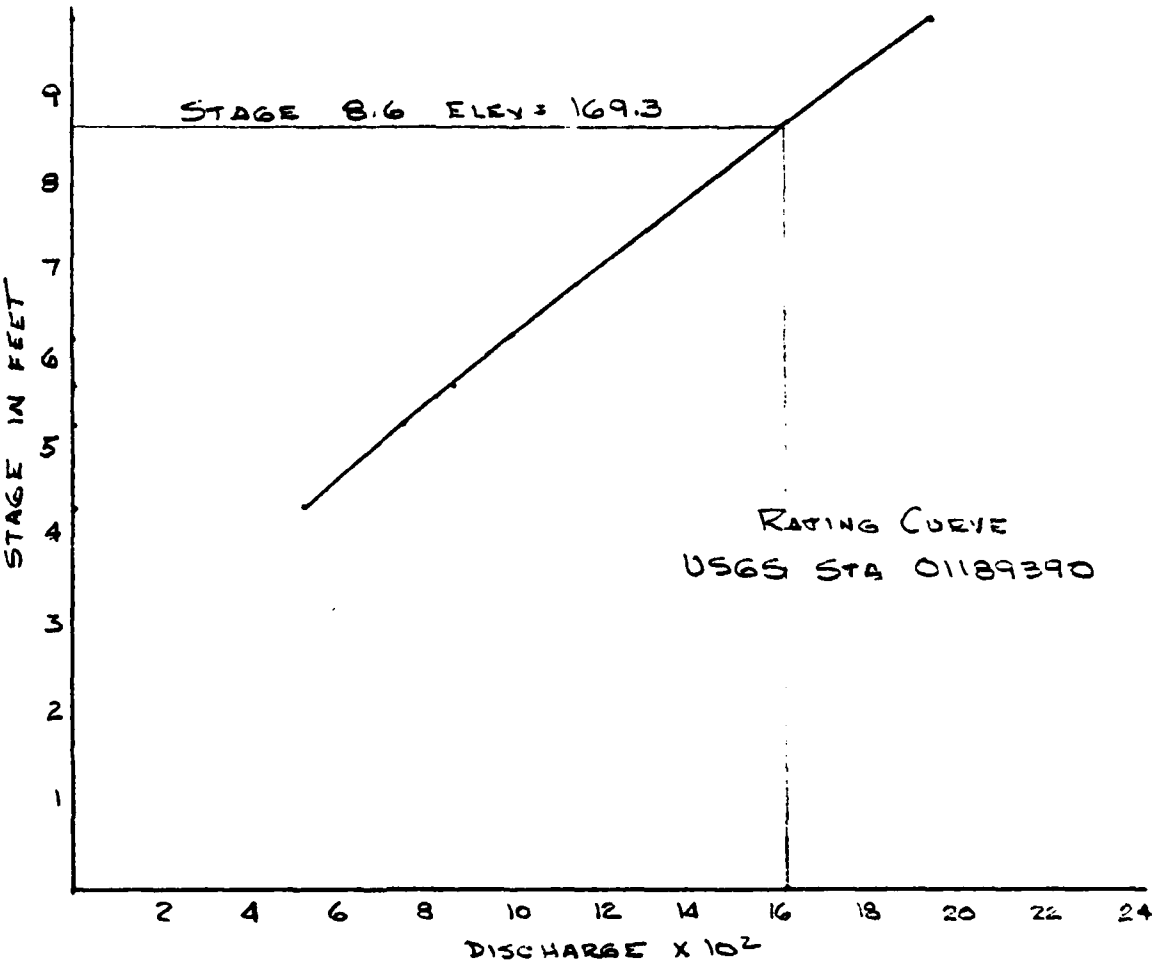
FROM U.S.G.S GAGE 01189390 DATA REPORT JT-76-1

STAGE	ELEV	Q
0	160.74	0
4.30	165.04	517
5.24	165.98	745
5.70	166.44	860
6.22	166.96	990
9.84	170.58	1940

BY RFB DATE 10-17-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 6 OF

CHKD. BY DATE INSPECTION OF DAMS PROJECT

SUBJECT MANITOOK LAKE, FAILURE ANALYSIS



RATING CURVE
USGS STA 01189390

At Q_{P_1} = 1612 CFS, STAGE 8.6, ELEV. 169.3

NO CORRECTION FOR STORAGE

DEDUCTION: STAGE CAN BE NO HIGHER 169.3 MSL
@ STA 117+00 ∴ USGS GAGE

PROJECT: MANITOOK

DESIGNER: RFB

DATE: 10-19-79

HYDROLOGIC AND CHANNEL INFORMATION

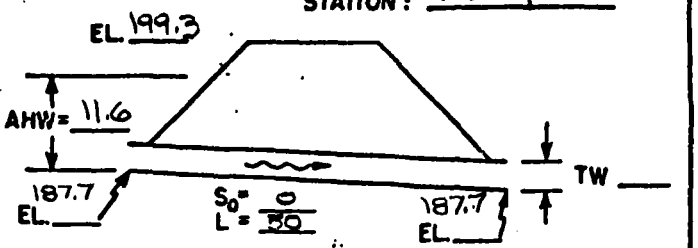
Q_1 = _____ TW_1 = _____

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: Rt 20 & 202



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	Q/W ~~SIZE~~	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	~~COMMENTS~~ ELEV.
			INLET CONT.		OUTLET CONTROL HW=H+h_o-LS_o											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	*h_o	LS_o	HW				
8H x 12W.	100	8.3			.5	<.4	<4	<4	9.9	9.9	0	9.9				197.6
	200	16.7			.5	<.4	<4	<4	10.3	10.3		10.3				198
	400	33.3			.5	.43	<4	<4	10.65	10.6		11.1				198.8
	600	50			.5	.97	4.2	4.2	11	11.0		11.97				199.7
	800	66.7			.5	1.7	5.1	4.6	11.25	11.2						
	1000	83.3			.5	2.35	6.0	7	11.55	11.6						
	1400	117			.5	5.3	7.5	7.8	12	12.0						

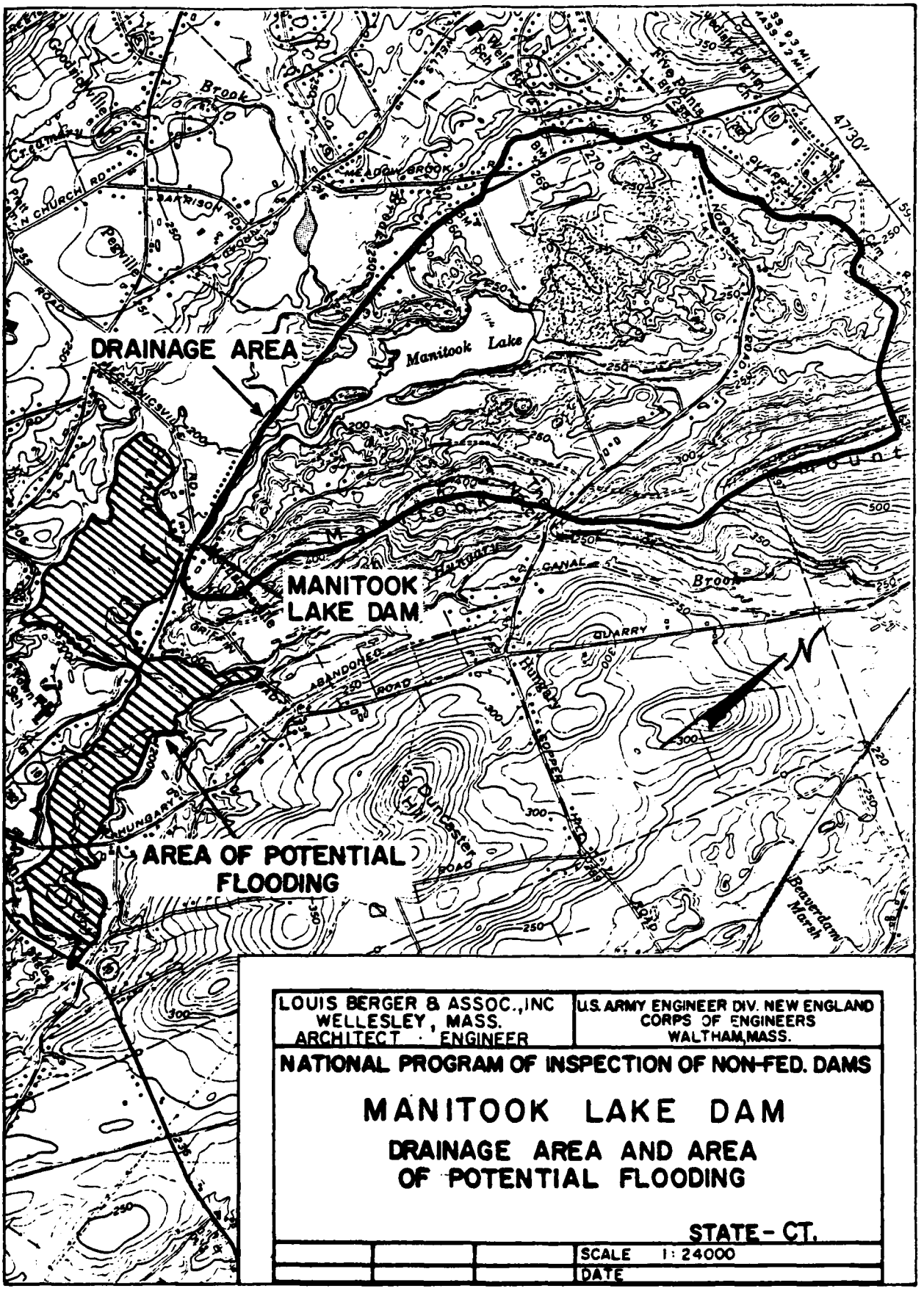
SUMMARY & RECOMMENDATIONS:

ROAD TOP OVERTOPS AT $Q \leq 400 + \frac{200(.5)}{187} \leq 515$ cfs

* FROM FHWA HYDRAULIC ENGINEERING CIRCULAR No. 5

Figure 7

D-19



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MANITOOK LAKE DAM

DRAINAGE AREA AND AREA OF POTENTIAL FLOODING

STATE - CT.

			SCALE 1:24000
			DATE

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY | MO | YR
CT	472	NED	CT	003	06				MANITOOK LAKE DAM	4158.1	7247.7	090CT79

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT
	MANITOOK LAKE

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(20) DIST FROM DAM (MI.)	(21) POPULATION
01	08	TR EAST BRANCH SALMON BROOK	GRANBY	1	6500

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT.)	(26) HYDRAULIC HEIGHT (FT.)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPSDT	1900	R	14	14	667	304	NED	N	N	N	N	

(28) REMARKS
21 CEMENTED STONEWALL WITH EARTH UPSTREAM, 22=ESTIMATED

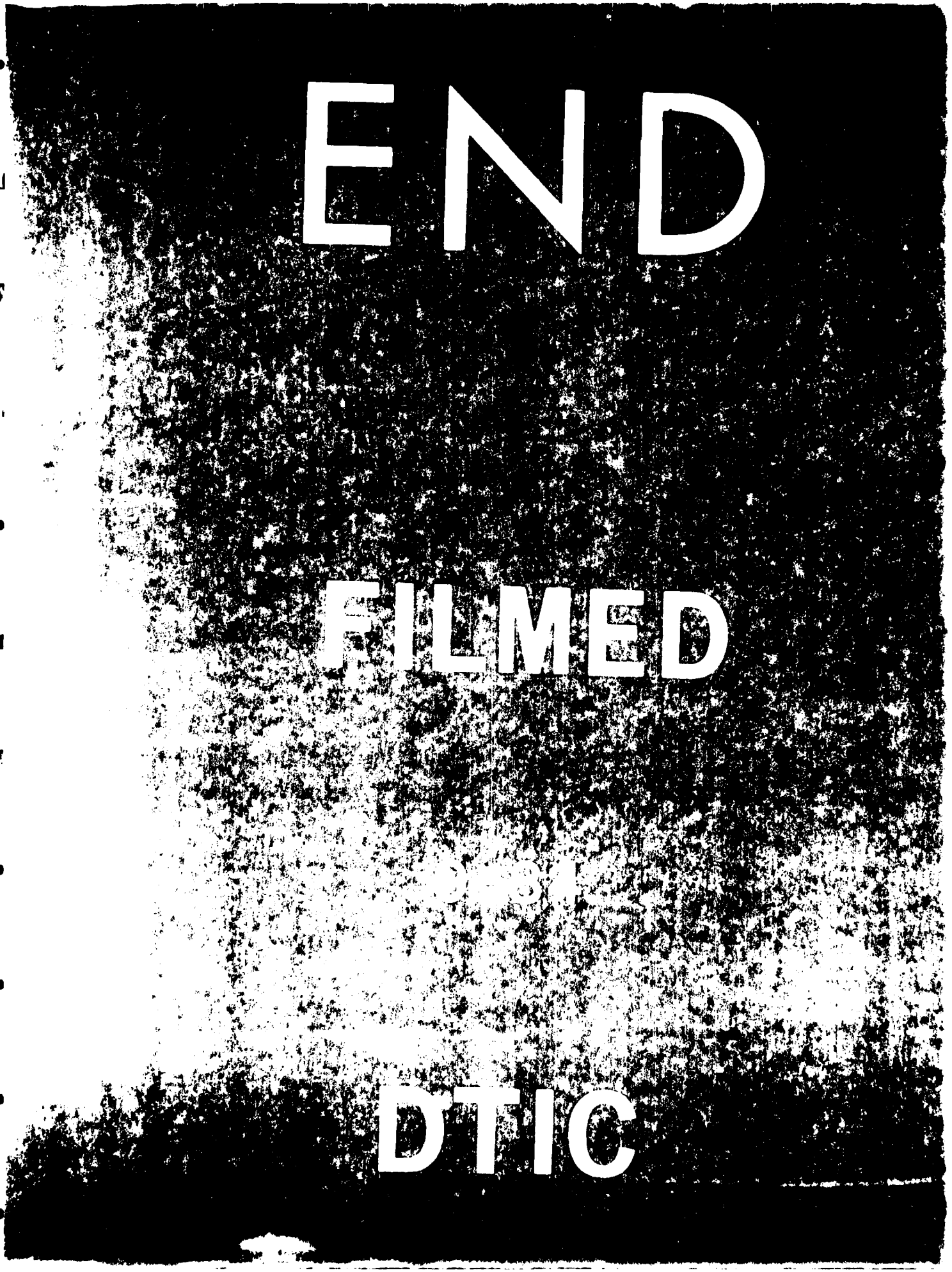
(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	108	U	6	97	1300											

(38) OWNER	(39) ENGINEERING BY	(40) CONSTRUCTION BY
JOSEPH RADWILLOWICZ		

(41) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(42) INSPECTION BY	(43) INSPECTION DATE DAY | MO | YR	(44) AUTHORITY FOR INSPECTION
LOUIS BERGER + ASSOCIATES, INC	090CT7[illegible]	PL92-367

(45) REMARKS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